

Fig. 1

PRIOR ART

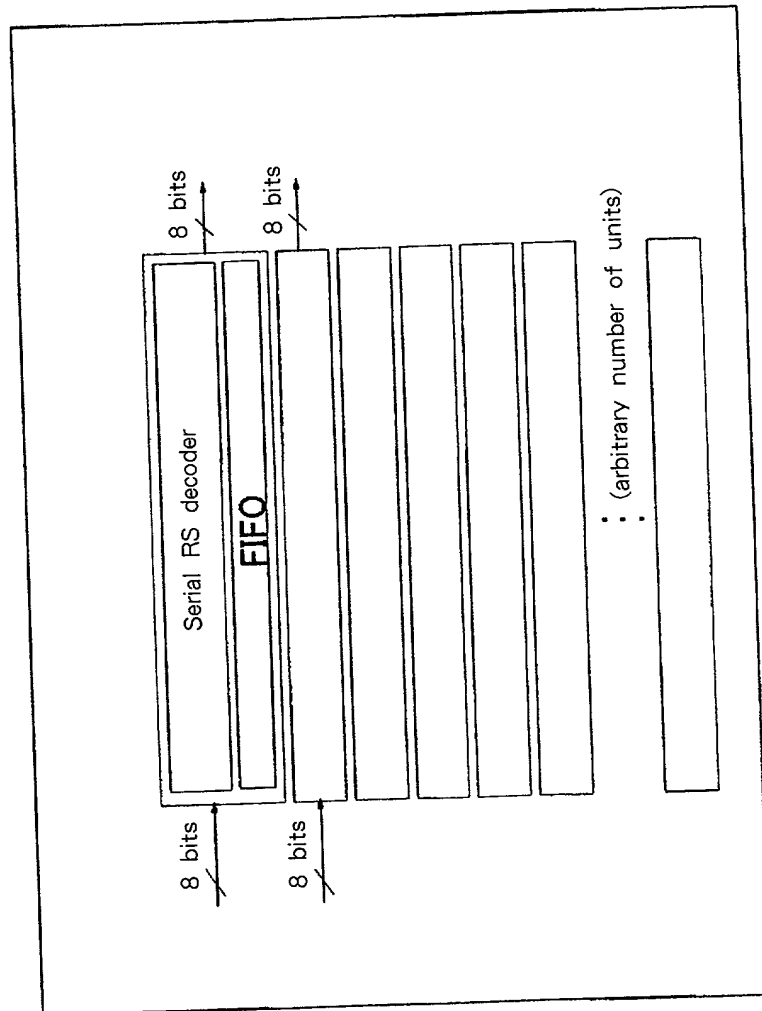


Fig. 2
PRIOR ART

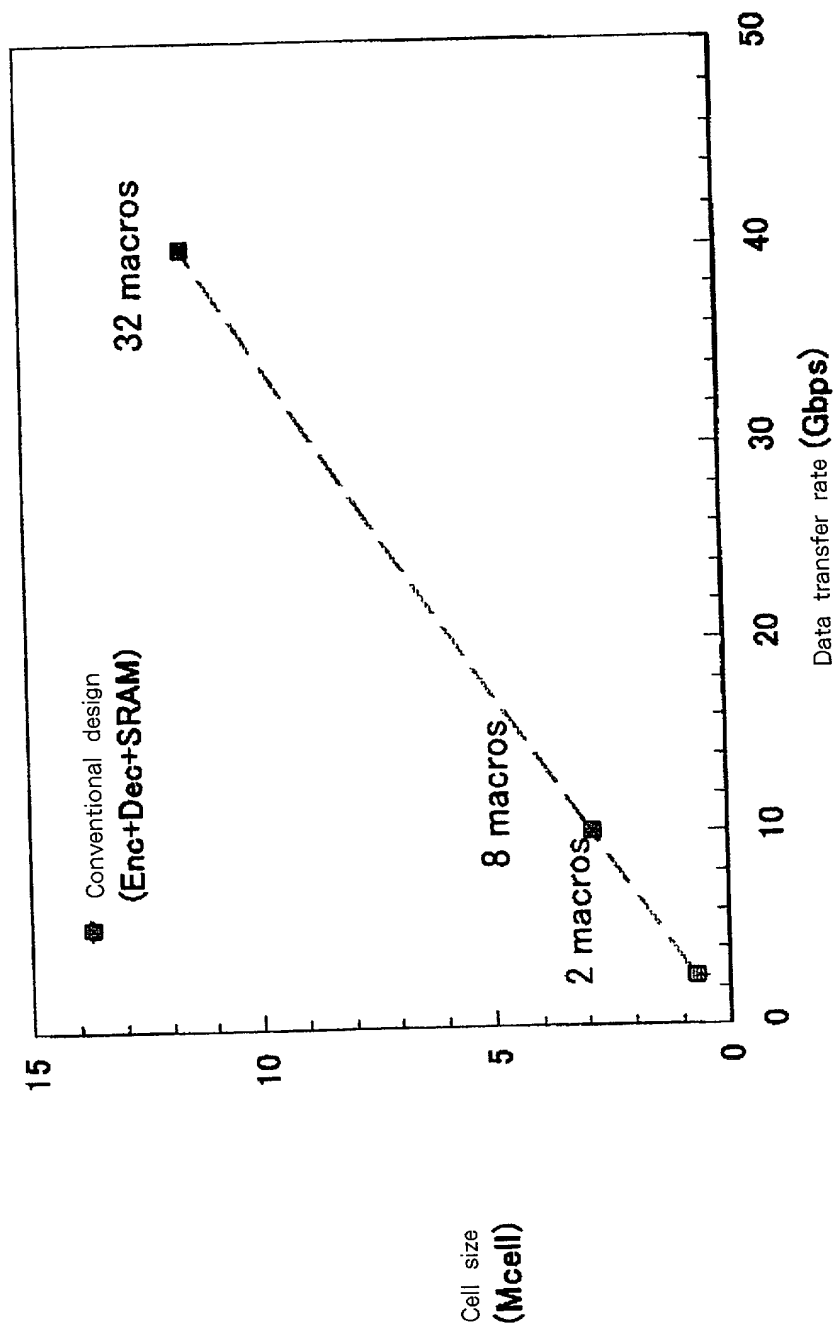


Fig. 3
PRIOR ART

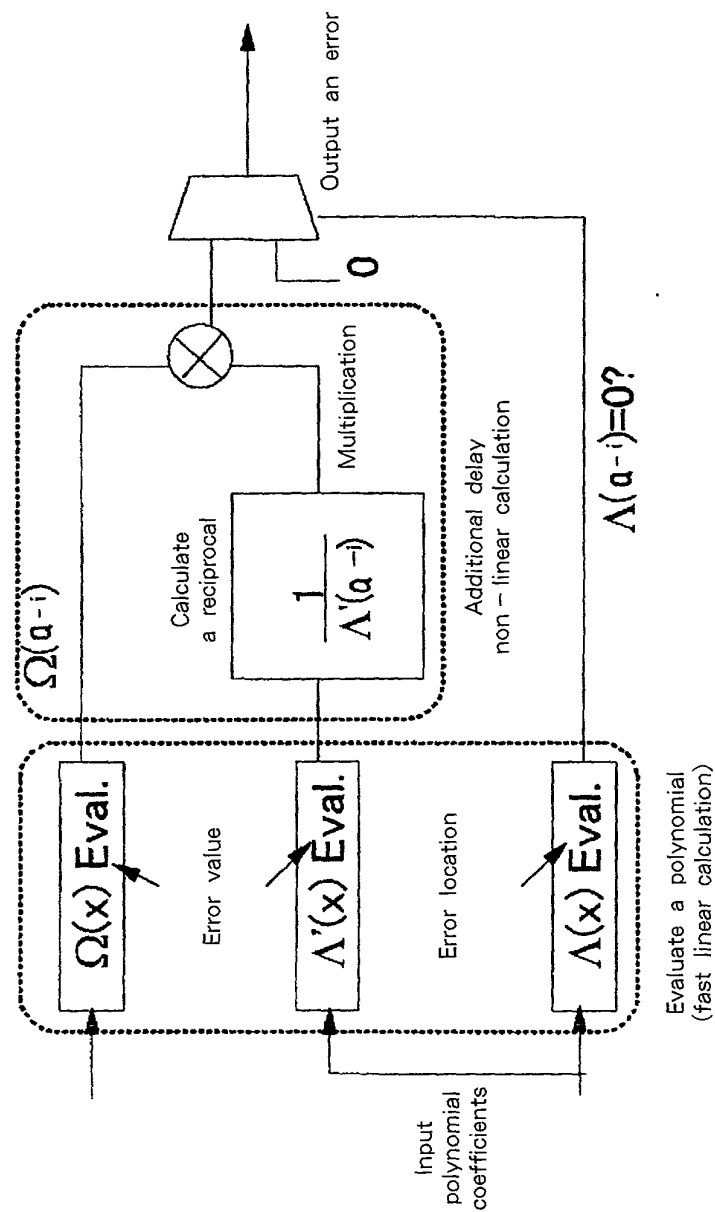


Fig. 4
PRIOR ART

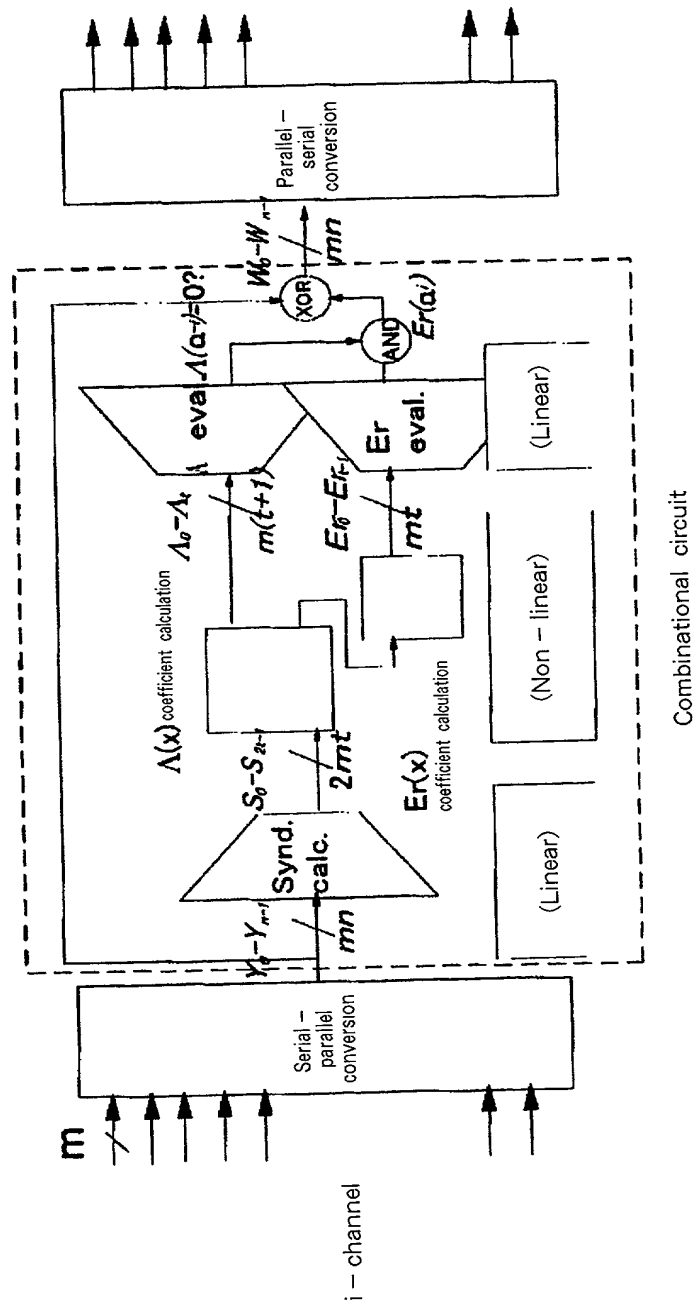


Fig. 5
PRIOR ART

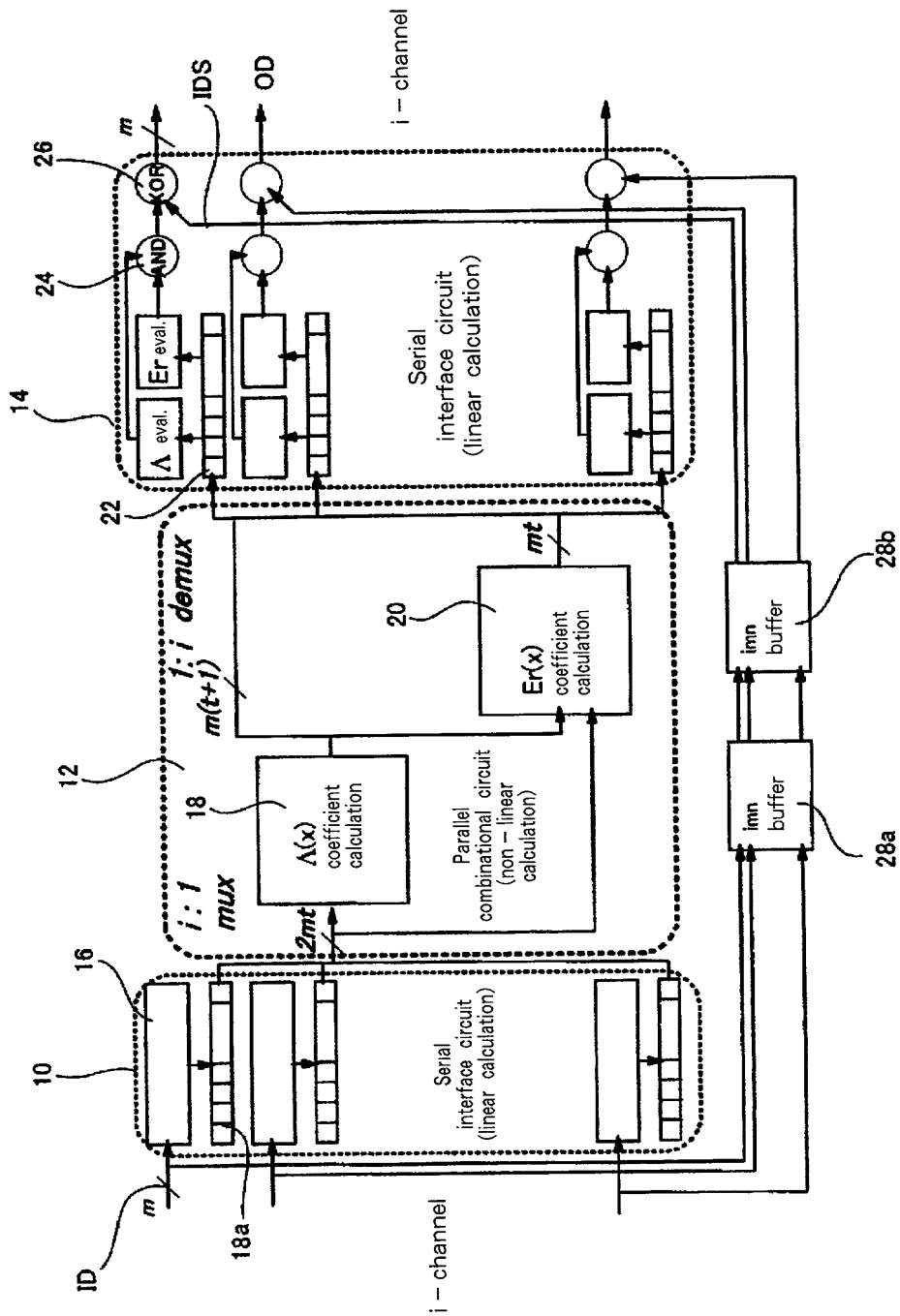


Fig. 6

PRIOR ART

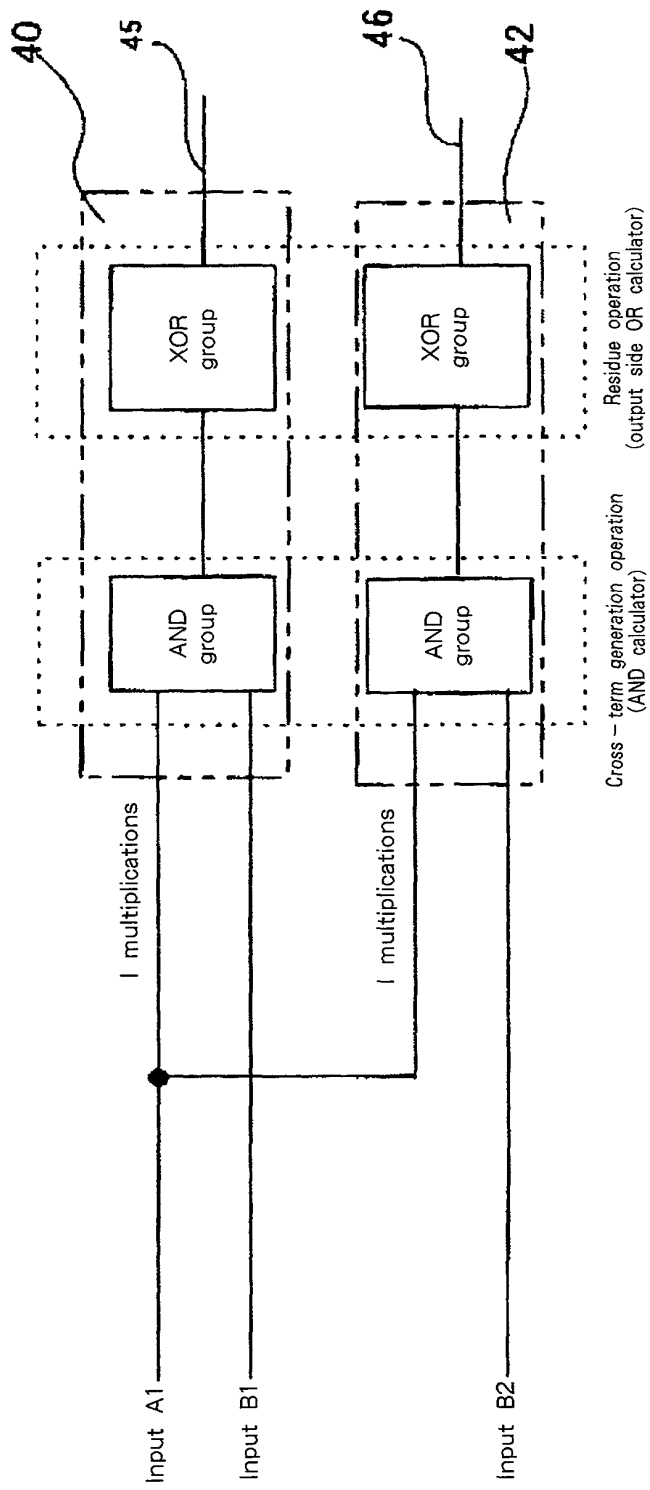


Fig. 7

PRIOR ART

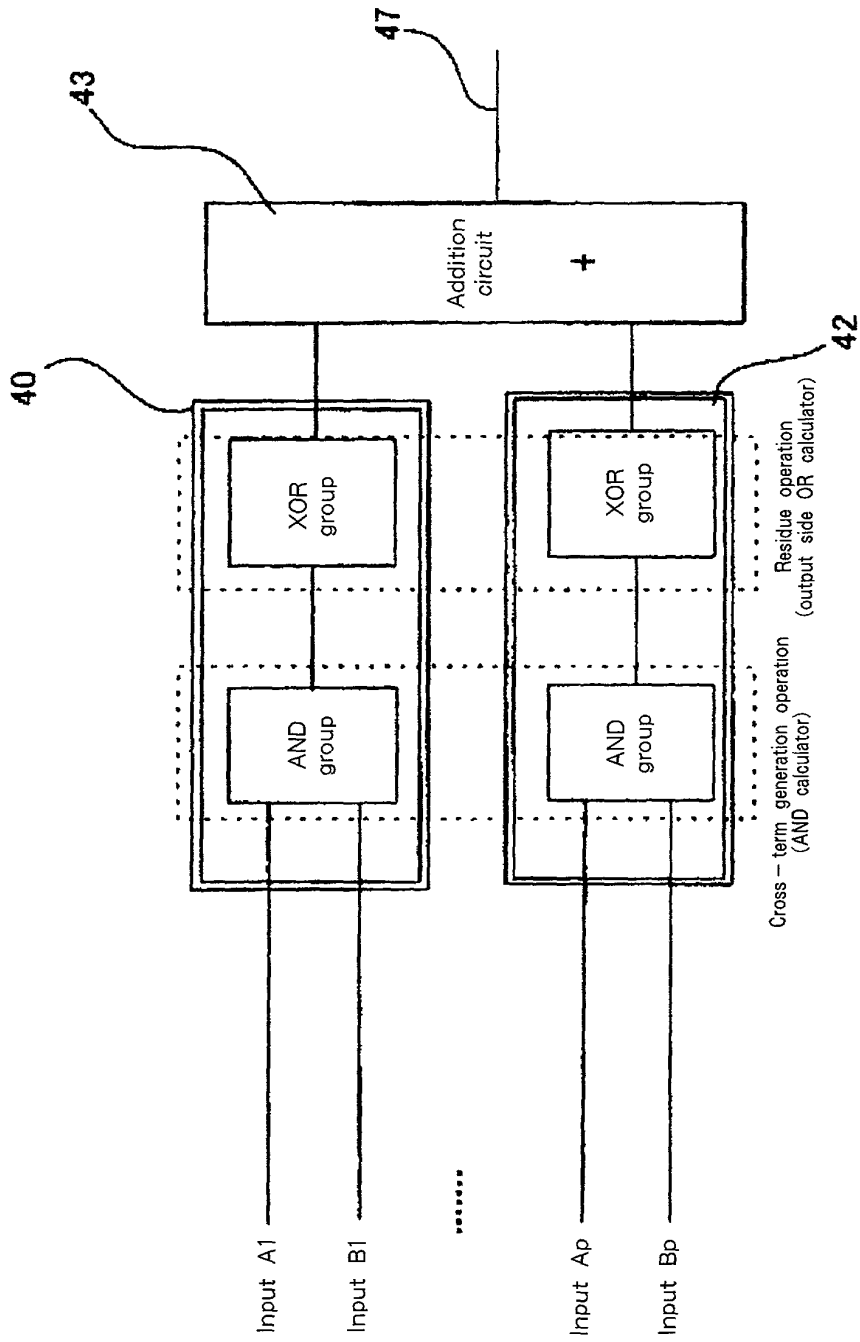


Fig. 8

PRIOR ART

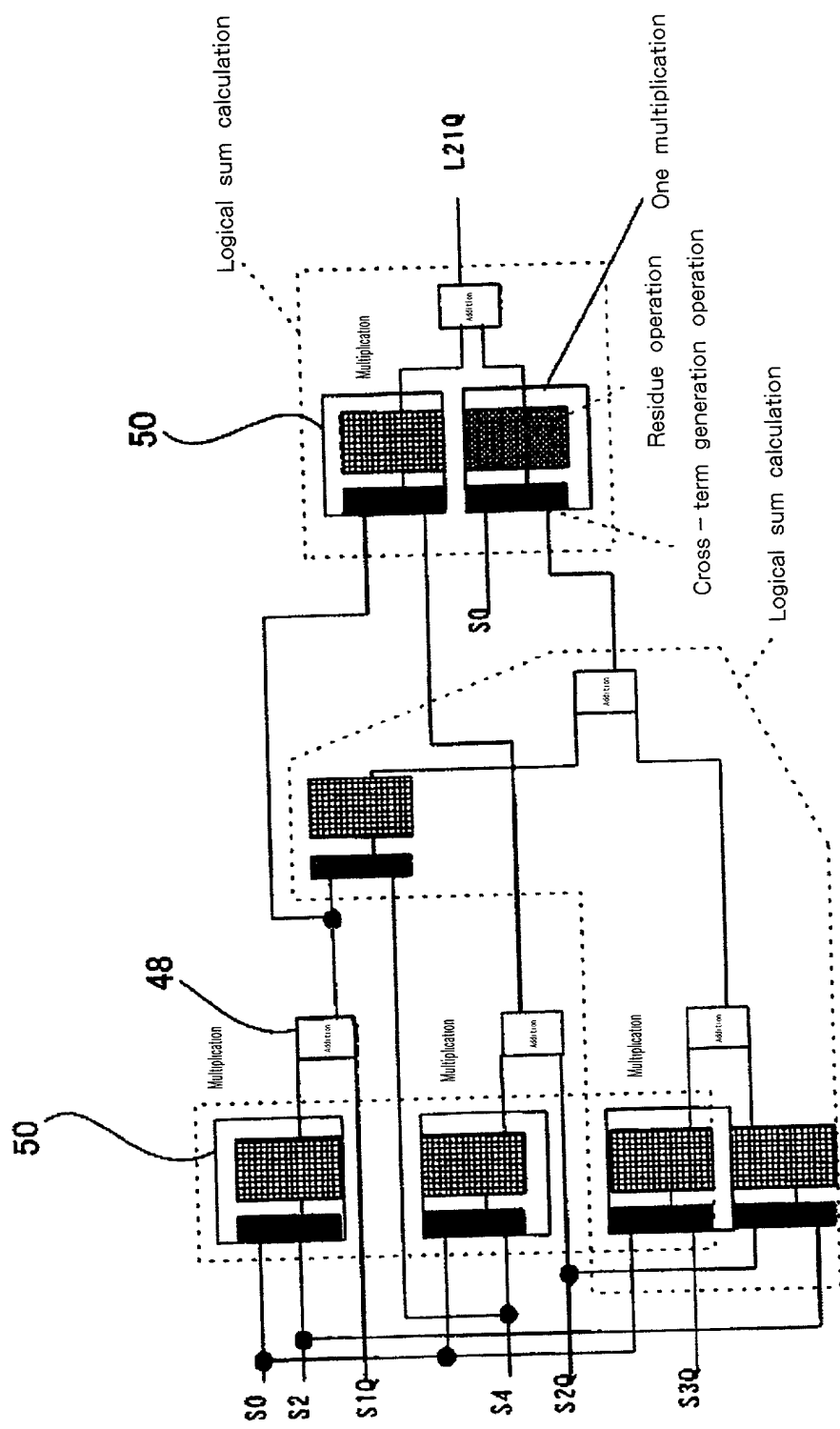
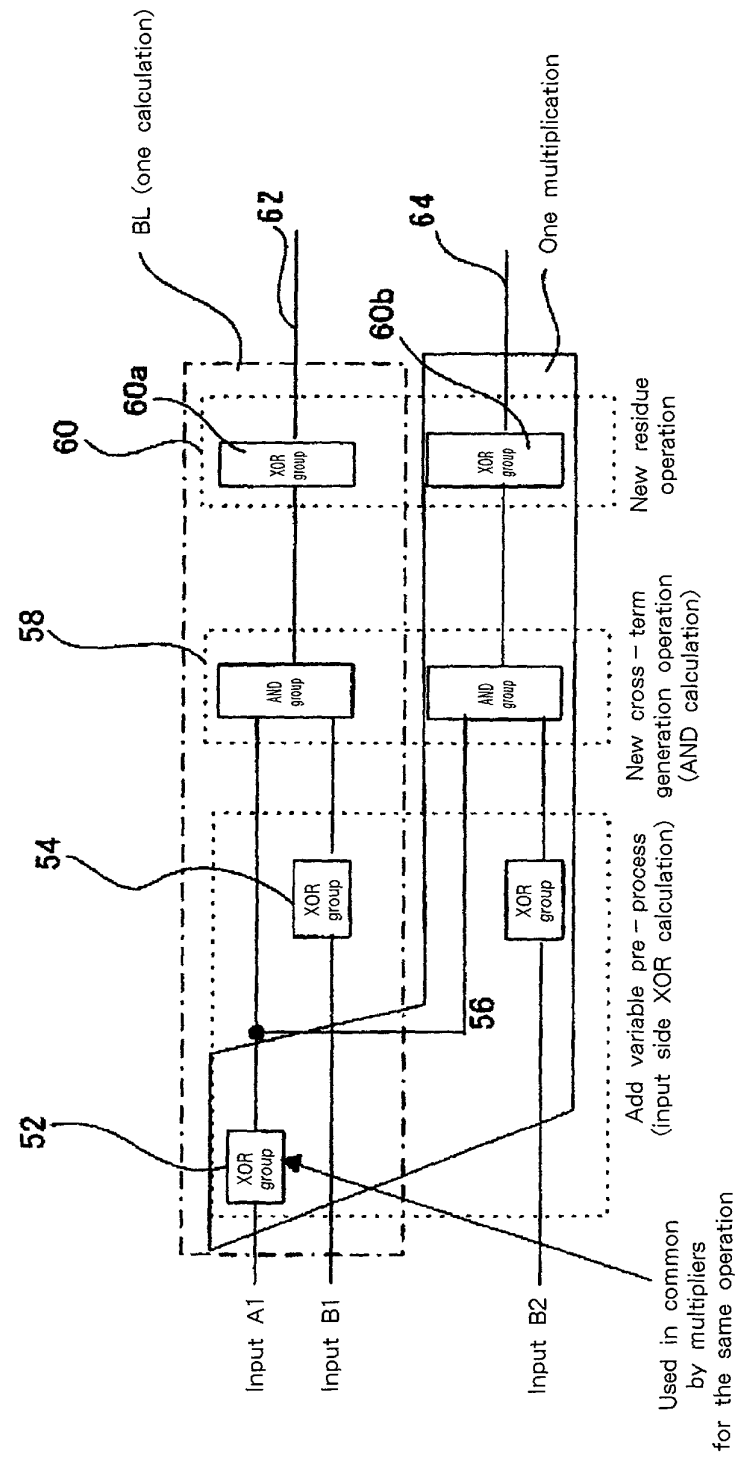


Fig. 9

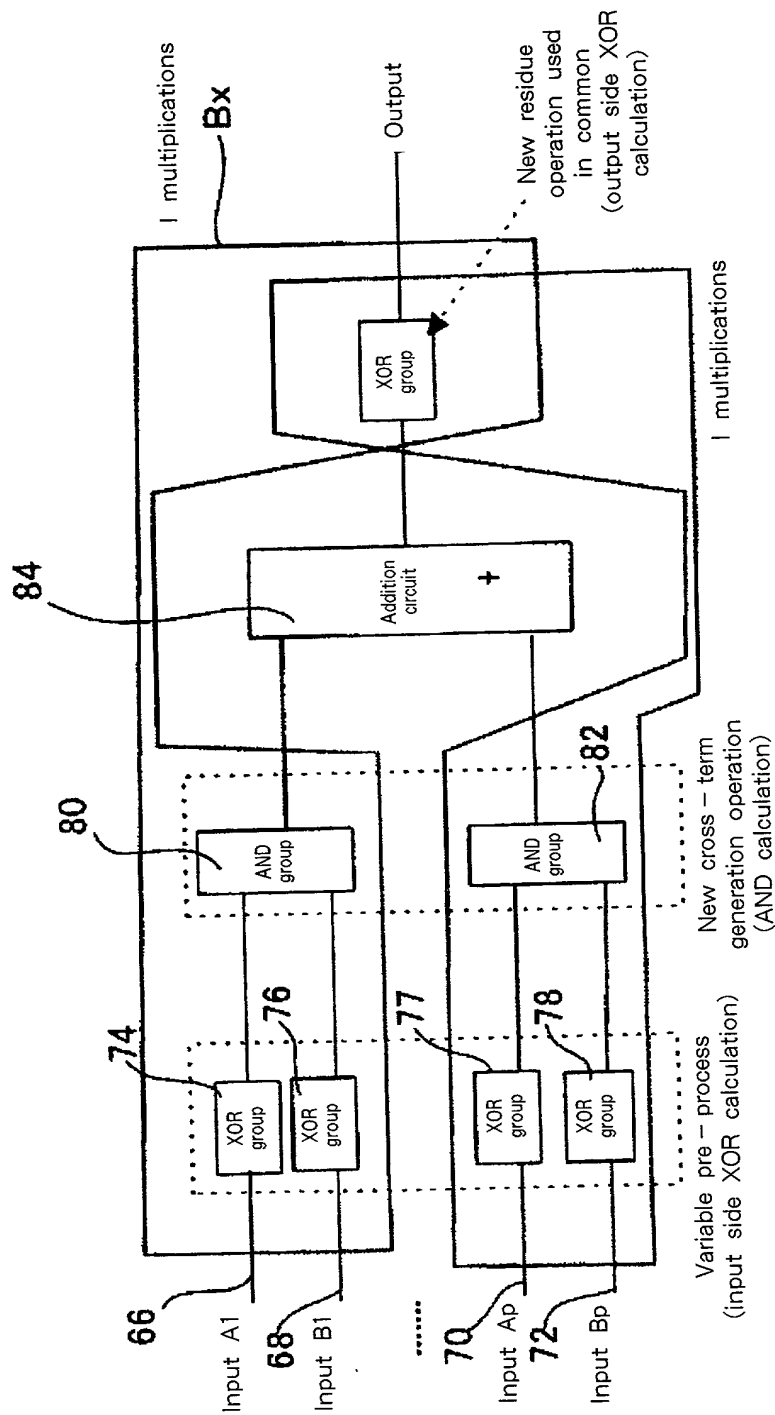
PRIOR ART



(other XOR group that is not used in common and may differ for each multiplication)

Fig. 10

PRIOR ART



XOR - AND - XOR may be employed even when this portion is not used in common

Fig. 11

PRIOR ART

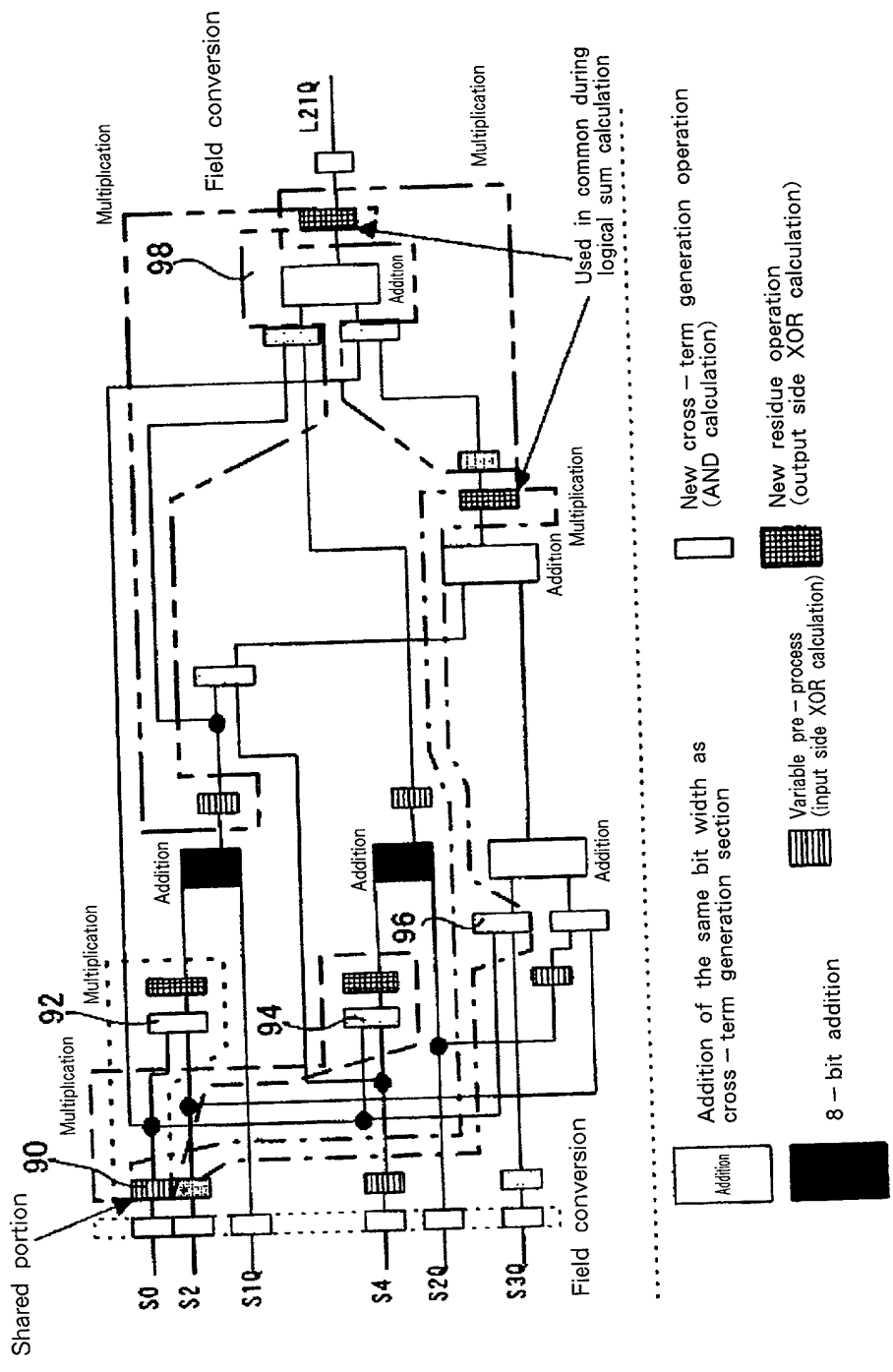


Fig. 12
PRIOR ART

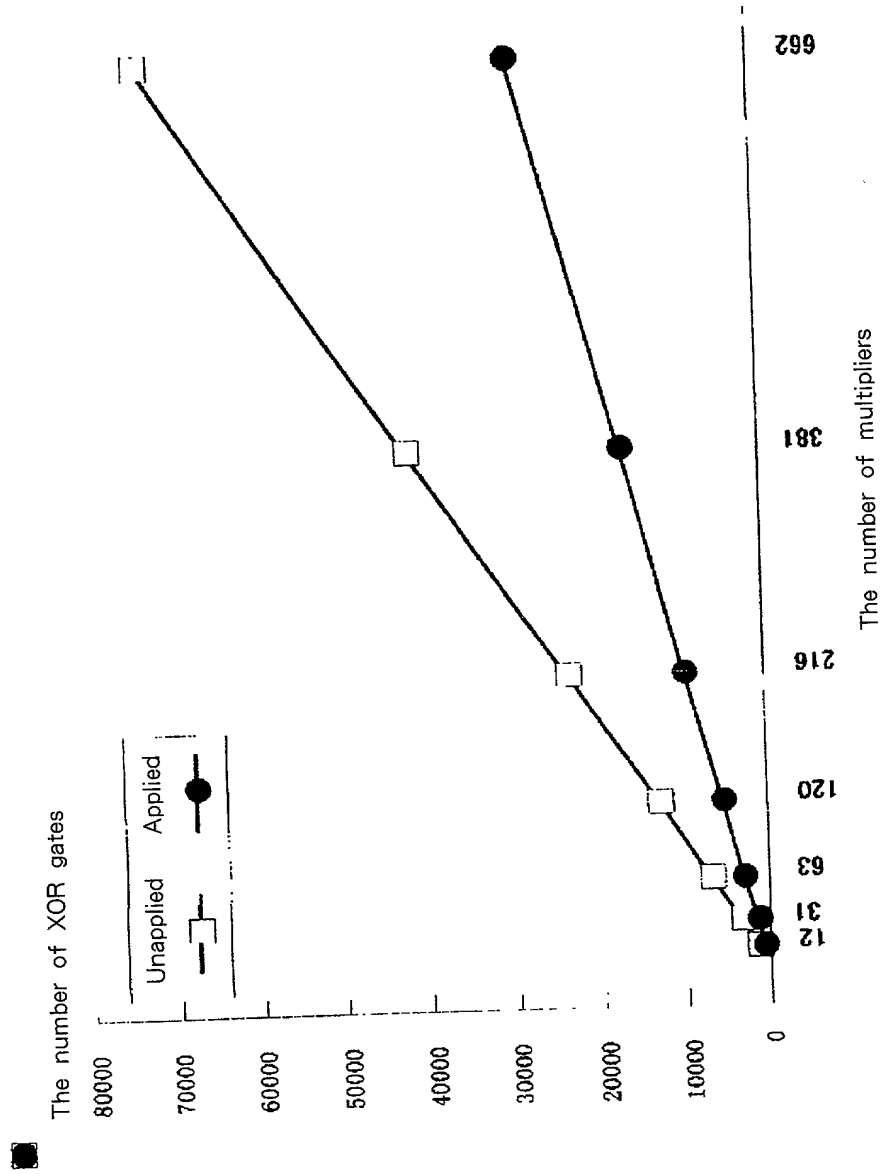


Fig. 13

PRIOR ART

$$\tilde{\Lambda}_1^{(1)} = S_1$$

$$\tilde{\Lambda}_0^{(1)} = S_0$$

Case where $l = 2$

$$\tilde{\Lambda}_2^{(2)} = \tilde{\Lambda}_1^{(1)} S_3 + S_2^2$$

$$\tilde{\Lambda}_1^{(2)} = \tilde{\Lambda}_0^{(1)} S_3 + \tilde{\Lambda}_1^{(1)} S_2$$

$$\tilde{\Lambda}_0^{(2)} = \tilde{\Lambda}_0^{(1)} S_2 + \tilde{\Lambda}_1^{(1)} S_1$$

Case where $l = 3$

$$\tilde{\Lambda}_3^{(3)} = \tilde{\Lambda}_2^{(2)} S_5 + S_1 S_4^2 + S_3^3$$

$$\tilde{\Lambda}_2^{(3)} = \tilde{\Lambda}_1^{(2)} S_5 + \tilde{\Lambda}_2^{(2)} S_4 + S_0 S_4^2 + S_2 S_3^2$$

$$\tilde{\Lambda}_1^{(3)} = \tilde{\Lambda}_0^{(2)} S_5 + \tilde{\Lambda}_1^{(2)} S_4 + \tilde{\Lambda}_2^{(2)} S_3$$

$$\tilde{\Lambda}_0^{(3)} = \tilde{\Lambda}_0^{(2)} S_4 + \tilde{\Lambda}_1^{(2)} S_3 + \tilde{\Lambda}_2^{(2)} S_2$$

Case where $l = 4$

$$\tilde{\Lambda}_4^{(4)} = \tilde{\Lambda}_3^{(3)} S_7 + \tilde{\Lambda}_2^{(3)} S_6^2 + S_4^4 + S_3 S_4^2 S_5 + S_3^2 S_5^2 + S_1 S_5^3$$

$$\tilde{\Lambda}_3^{(4)} = \tilde{\Lambda}_2^{(3)} S_7 + \tilde{\Lambda}_3^{(3)} S_6 + \tilde{\Lambda}_1^{(3)} S_6^2 + S_3 S_4^3 + S_2 S_4^2 S_5 + S_1 S_4 S_5^2 + S_0 S_5^3$$

$$\tilde{\Lambda}_2^{(4)} = \tilde{\Lambda}_1^{(3)} S_7 + \tilde{\Lambda}_2^{(3)} S_6 + \tilde{\Lambda}_3^{(3)} S_5 + \tilde{\Lambda}_0^{(3)} S_6^2 + S_3^2 S_4^2 + S_2 S_4^3 + S_2^2 S_5^2 + S_0 S_4 S_5^2$$

$$\tilde{\Lambda}_1^{(4)} = \tilde{\Lambda}_0^{(3)} S_7 + \tilde{\Lambda}_1^{(3)} S_6 + \tilde{\Lambda}_2^{(3)} S_5 + \tilde{\Lambda}_3^{(3)} S_4$$

$$\tilde{\Lambda}_0^{(4)} = \tilde{\Lambda}_0^{(3)} S_6 + \tilde{\Lambda}_1^{(3)} S_5 + \tilde{\Lambda}_2^{(3)} S_4 + \tilde{\Lambda}_3^{(3)} S_3$$

Fig. 14

PRIOR ART

$$\Lambda_i^{(l)} = \frac{\tilde{\Lambda}_i^{(l)}}{\tilde{\Lambda}_0^{(l)}}, \quad i = 1, \dots, l$$

$$\tilde{\Lambda}_0^{(l)} = \begin{vmatrix} S_0 & \cdots & S_{l-1} \\ \vdots & \ddots & \vdots \\ S_{l-1} & \cdots & S_{2l-2} \end{vmatrix},$$

$$\tilde{\Lambda}_i^{(l)} = \begin{vmatrix} S_0 & \cdots & S_{l-1} \\ \vdots & \ddots & \vdots \\ S_{l+i-1} & \cdots & S_{2l+i-2} \\ S_{l+i} & \cdots & S_{2l+i-1} \\ \vdots & \ddots & \vdots \\ S_l & \cdots & S_{2l-1} \end{vmatrix}, \quad i = 1, \dots, l-1$$

$$\tilde{\Lambda}_l^{(l)} = \begin{vmatrix} S_1 & \cdots & S_l \\ \vdots & \ddots & \vdots \\ S_l & \cdots & S_{2l-1} \end{vmatrix}.$$

Fig. 15

PRIOR ART

$$\Gamma_0^{(l+1)} = \begin{vmatrix} s_0 & s_1 & \cdots & s_{l-1} \\ s_1 & \ddots & & \vdots \\ \vdots & & \ddots & \vdots \\ s_{l-1} & \cdots & \cdots & s_{2l-2} \end{vmatrix},$$

$$\Gamma_l^{(l+1)} = \begin{vmatrix} s_0 & \cdots & s_{l-1-i} & s_{l+1-i} & \cdots & s_l \\ \vdots & & \vdots & \vdots & & \vdots \\ s_{l-1-i} & \cdots & s_{2l-1-i} & s_{2l-i} & \cdots & s_{2l-1-i} \\ s_{l+1-i} & \cdots & s_{2l-i} & s_{2l+1-i} & \cdots & s_{2l+1-i} \\ \vdots & & \vdots & \vdots & & \vdots \\ s_l & \cdots & s_{2l-1-i} & s_{2l+1-i} & \cdots & s_{2l} \end{vmatrix} \quad i = 1, \cdots, l-1$$

$$\Gamma_l^{(l+1)} = \begin{vmatrix} s_2 & \cdots & \cdots & s_{l+1} \\ \vdots & \ddots & & \vdots \\ \vdots & & \ddots & \vdots \\ s_{l+1} & \cdots & \cdots & s_{2l} \end{vmatrix}.$$

Fig. 16

PRIOR ART

$$\Gamma_0^{(1)} = 1$$

$$\Gamma_0^{(2)} = S_0$$

$$\Gamma_1^{(2)} = S_2$$

$$\Gamma_0^{(3)} = S_0 S_2 + S_1^2$$

$$\Gamma_1^{(3)} = S_0 S_4 + S_2^2$$

$$\Gamma_2^{(3)} = S_2 S_4 + S_3^2$$

$$\Gamma_0^{(4)} = \Gamma_0^{(3)} S_4 + S_0 S_3^2 + S_2^3$$

$$\Gamma_1^{(4)} = \Gamma_0^{(3)} S_6 + S_0 S_4^2 + S_2 S_3^2$$

$$\Gamma_2^{(4)} = \Gamma_1^{(3)} S_6 + S_0 S_3^2 + S_4 S_3^2$$

$$\Gamma_3^{(4)} = \Gamma_2^{(3)} S_6 + S_2 S_3^2 + S_4 S_4^2$$

$$\Gamma_0^{(5)} = \Gamma_0^{(4)} S_6 + \Gamma_0^{(3)} S_3^2 + \Gamma_1^{(3)} S_4^2 + \Gamma_2^{(3)} S_3^2$$

$$\Gamma_1^{(5)} = \Gamma_0^{(4)} S_8 + \Gamma_0^{(3)} S_6^2 + \Gamma_1^{(3)} S_3^2 + \Gamma_2^{(3)} S_4^2$$

$$\det 03 = S_0 S_6 + S_3^2$$

$$\det 24 = S_2 S_6 + S_4^2$$

$$\Gamma_2^{(5)} = \Gamma_1^{(4)} S_8 + \Gamma_0^{(3)} S_7^2 + \det 03 \cdot S_3^2 + \det 24 \cdot S_4^2$$

$$\det 45 = S_4 S_6 + S_3^2$$

$$\Gamma_3^{(5)} = \Gamma_2^{(4)} S_8 + \Gamma_1^{(3)} S_7^2 + \det 03 \cdot S_6^2 + \det 45 \cdot S_4^2$$

$$\Gamma_4^{(5)} = \Gamma_3^{(4)} S_8 + \Gamma_2^{(3)} S_7^2 + \det 24 \cdot S_6^2 + \det 45 \cdot S_3^2$$

$$\Gamma_0^{(6)} = \Gamma_0^{(5)} S_8 + \Gamma_0^{(4)} S_7^2 + \Gamma_1^{(4)} S_6^2 + \Gamma_2^{(4)} S_3^2 + \Gamma_3^{(4)} S_4^2$$

Fig. 17

PRIOR ART

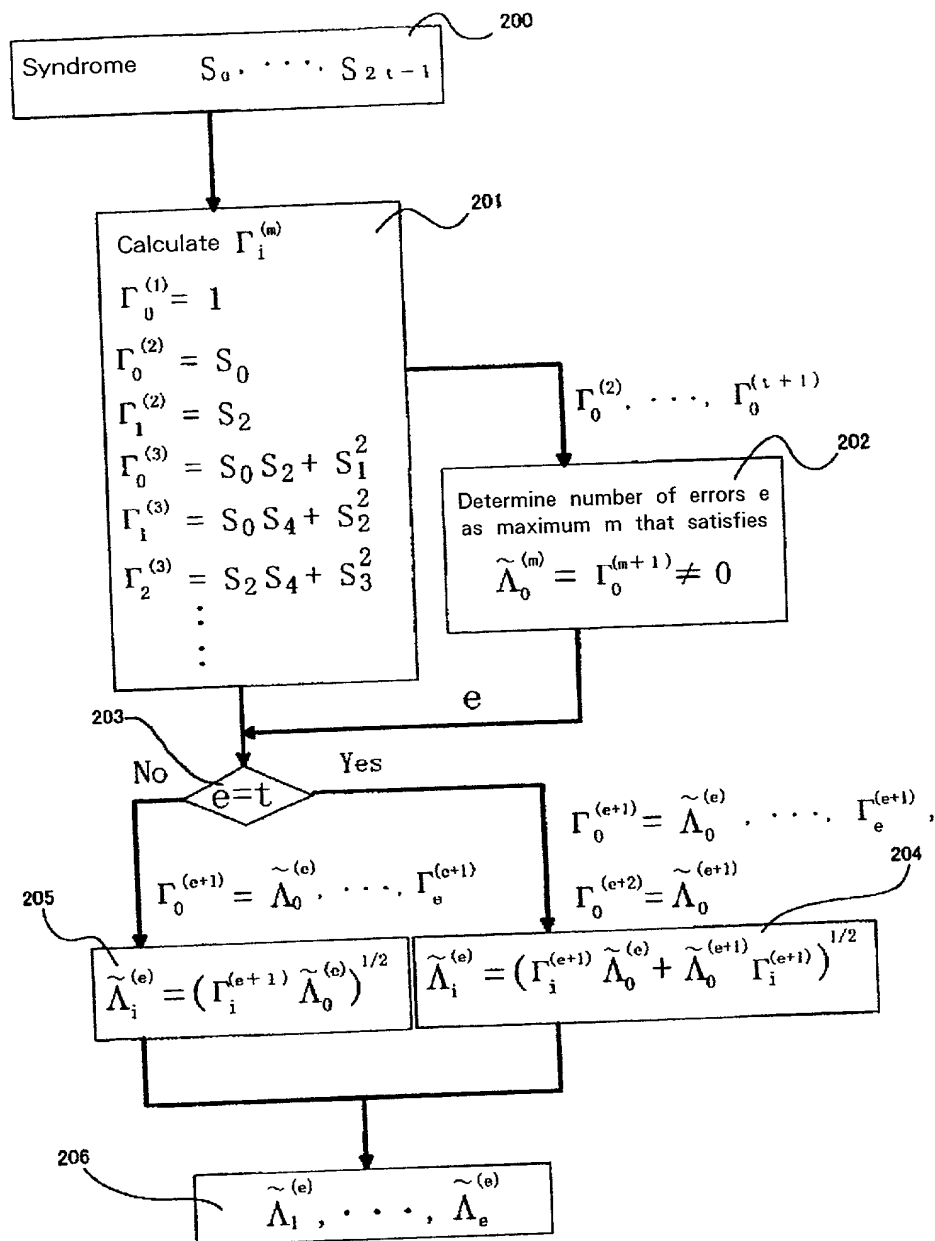


Fig. 18

PRIOR ART

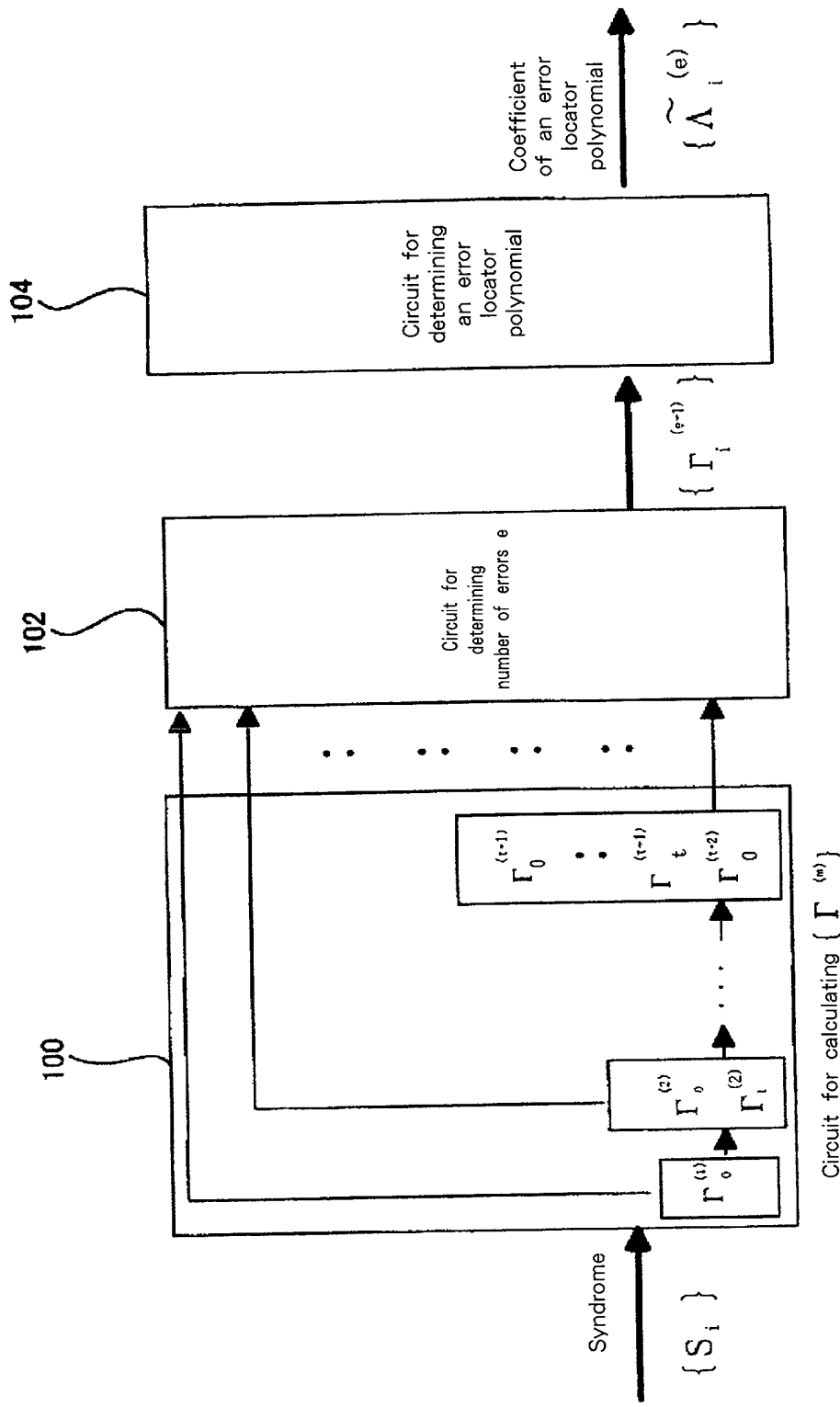


Fig. 19

PRIOR ART

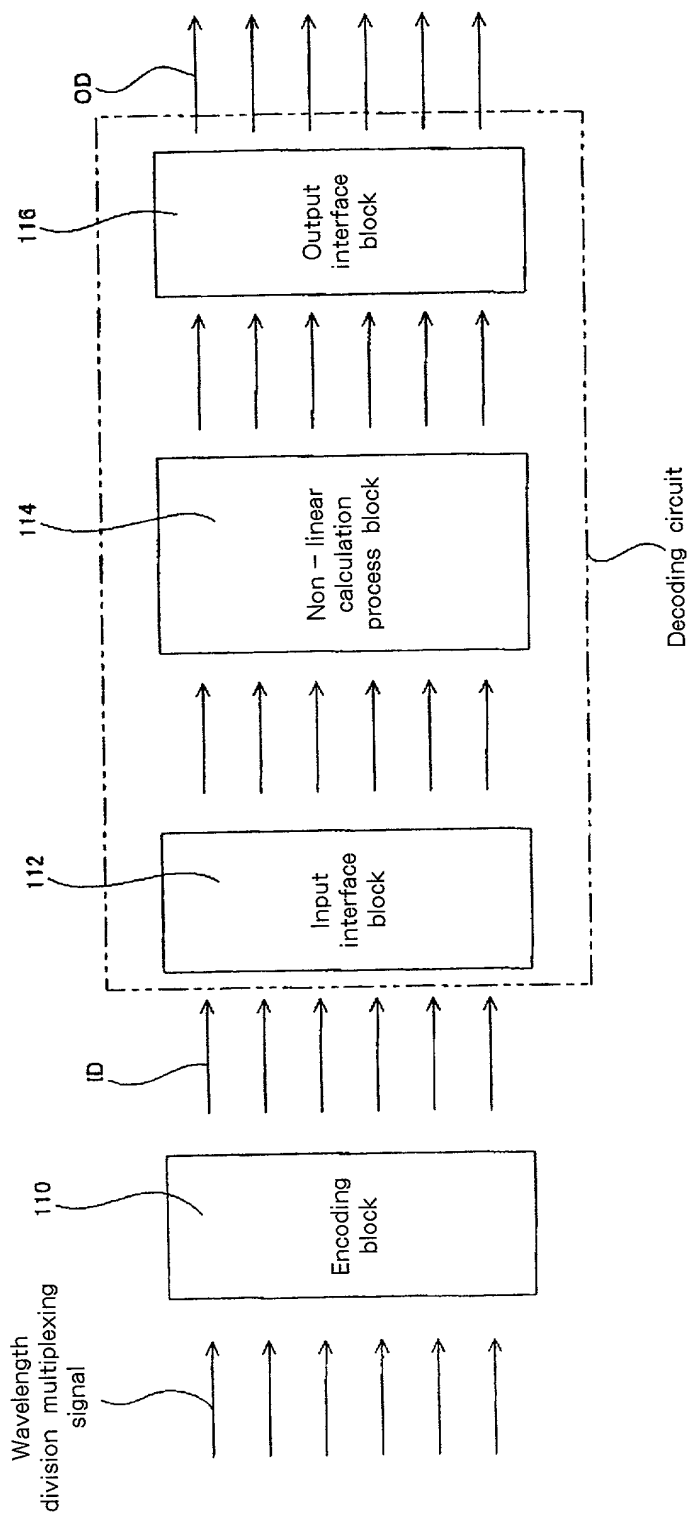


Fig. 20

PRIOR ART